

# **NASA Earth Science and Applications**

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Science Mission Directorate**

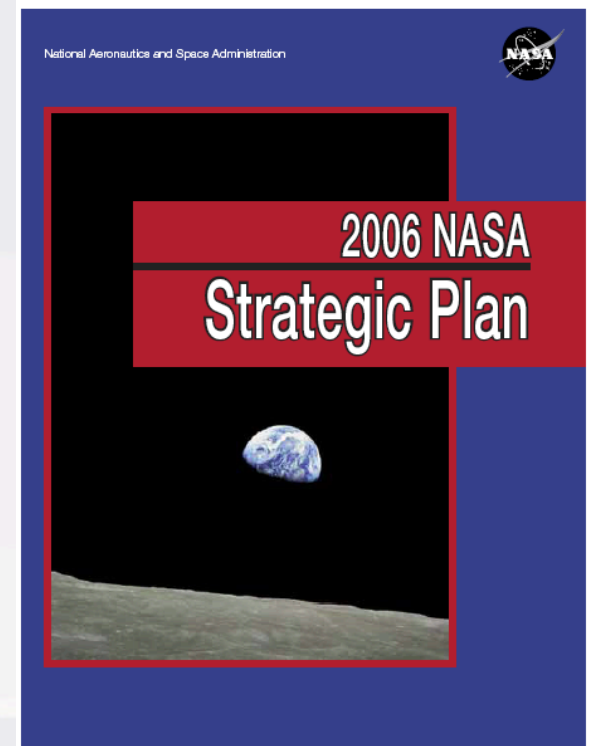
**9 January 2009  
Workshop on Sustainable Urban Management**

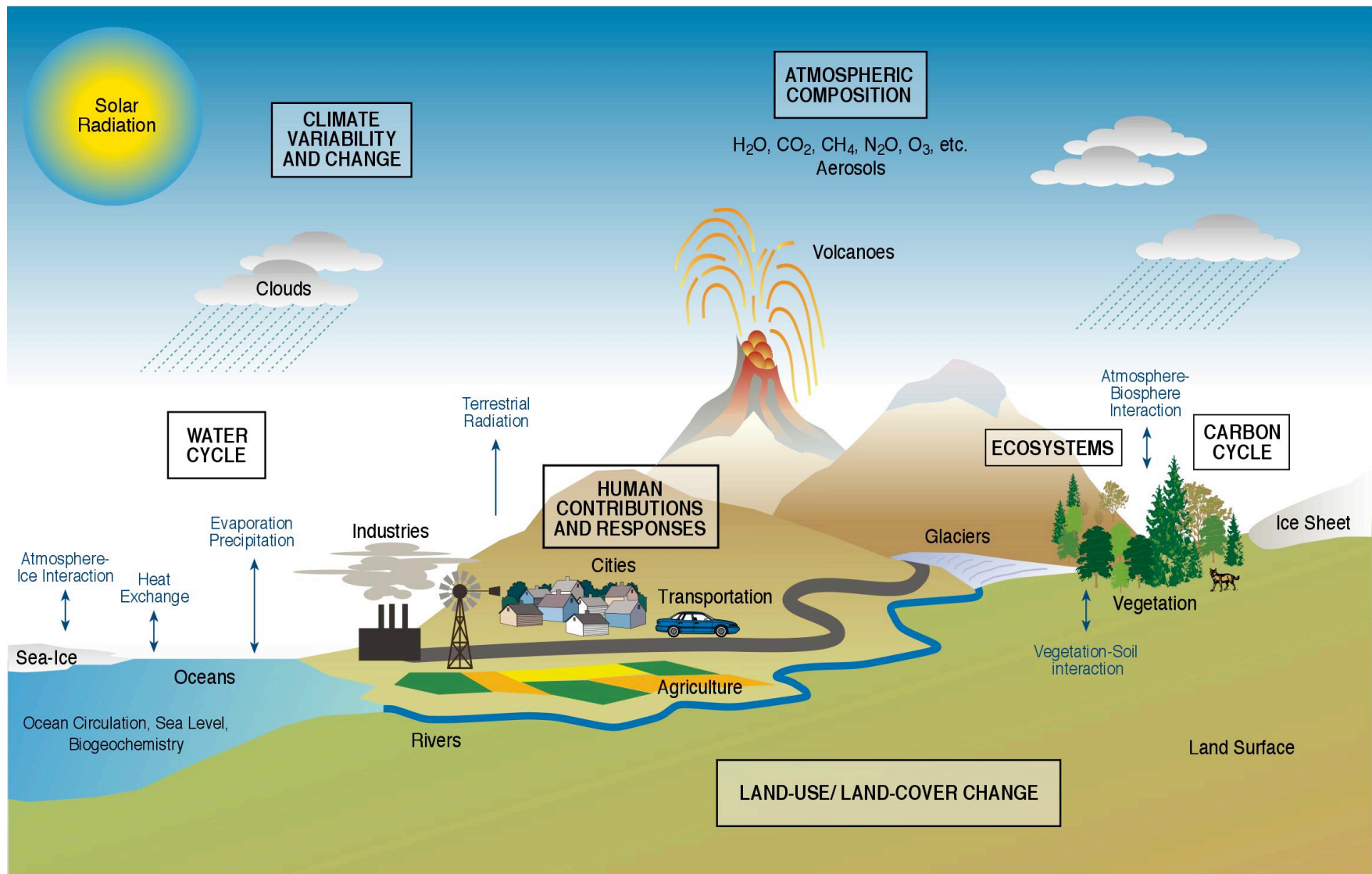
NASA continues the objectives for space exploration established in the National Aeronautics and Space Act of 1958:

***To pioneer the future in space exploration,  
Scientific discovery, and aeronautics research.***

### ***NASA Science Goals:***

1. ***Study Earth from space to advance scientific understanding and meet societal needs. (Earth Science)***
2. Understand the Sun and its effects on Earth and the solar system. (Heliophysics)
3. Advance scientific knowledge of the origin and history of the solar system, the potential for life elsewhere, and the hazards and resources present as humans explore space. (Planetary Science)
4. Discover the origin, structure, evolution, and destiny of the universe, and search for Earth-like planets. (Astrophysics)





**NASA Earth Science Goal:**  
*Study Earth from space to advance scientific understanding and meet societal needs.*



How is the Earth system changing?

What is the cause of these changes?

What is the Earth's response to change?

What are the consequences for human civilization?

How will the Earth system change in the future?





***Understanding the complex, changing planet on which we live, how it supports life, and how human activities affect its ability to do so in the future is one of the greatest intellectual challenges facing humanity. It is also one of the most important challenges for society as it seeks to achieve prosperity, health, and sustainability.***

**National Research Council, 2005**





# NASA Earth Science

An end-to-end approach:

1. Build and operate research ***missions***
2. Make ***data products*** available to the science community
3. Conduct and sponsor ***research***
4. Discover and develop ***applications***
5. Develop ***technologies***
6. Education and Public Outreach



# NASA Operating Research Missions

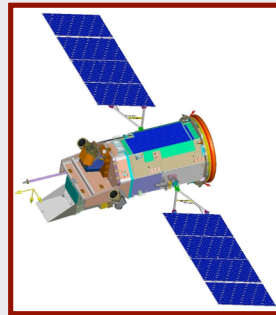




# Missions in Formulation and Implementation



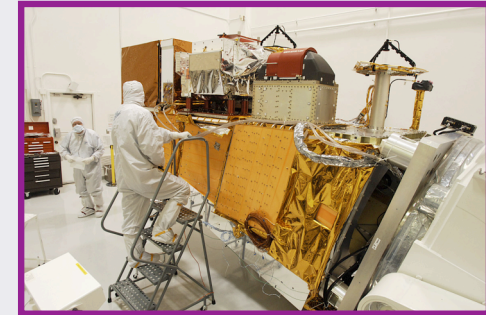
OCO  
1/2009



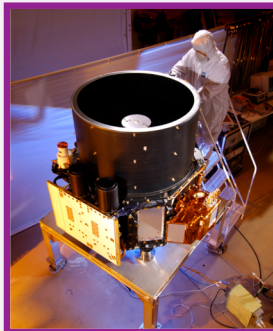
GLORY  
6/09



AQUARIUS  
5/2010



NPP  
6/2010



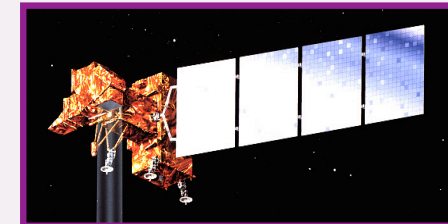
ICESat-II  
2015



SMAP  
2012



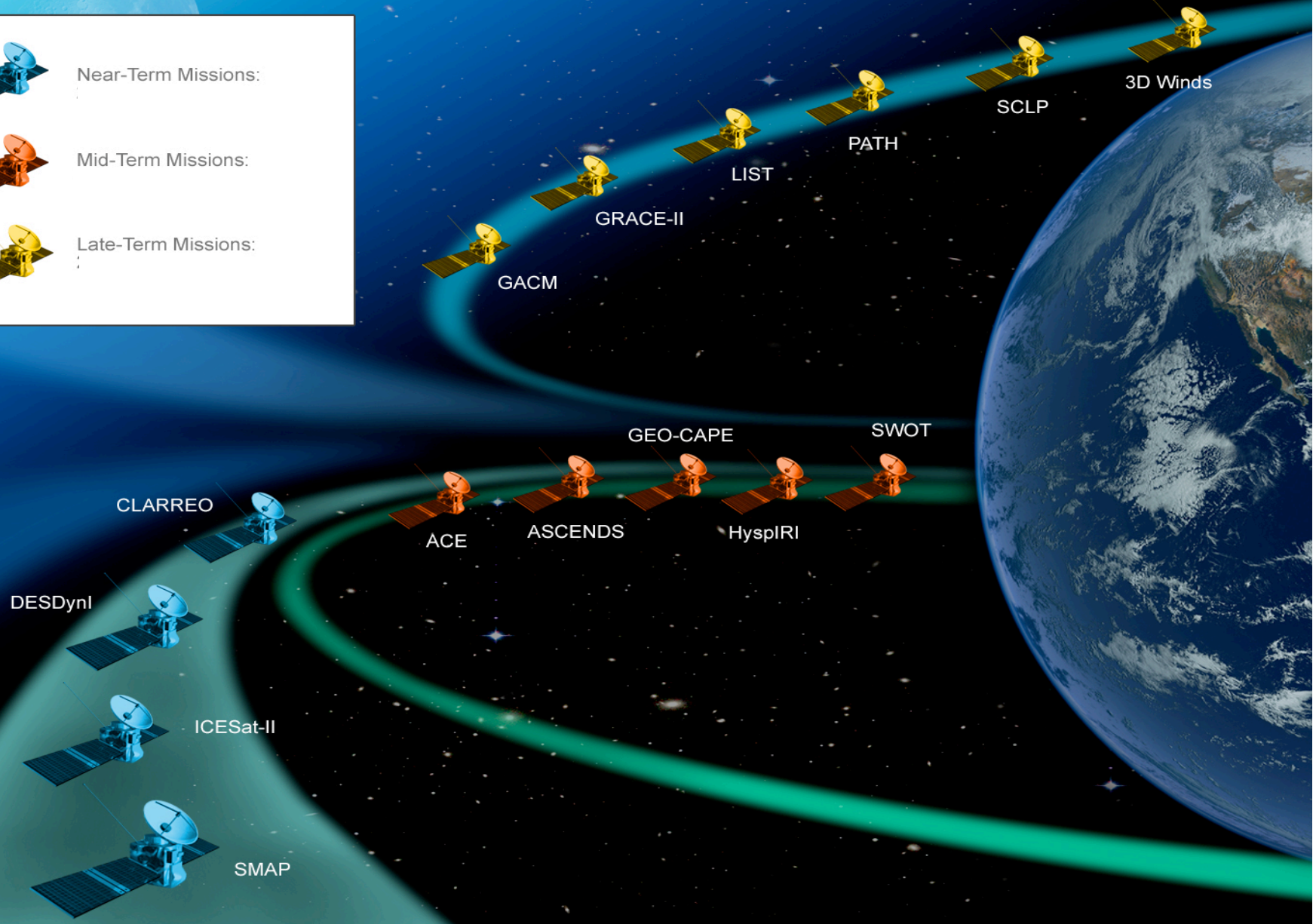
GPM  
6/2013, 11/2014



LDCM  
likely late 2012

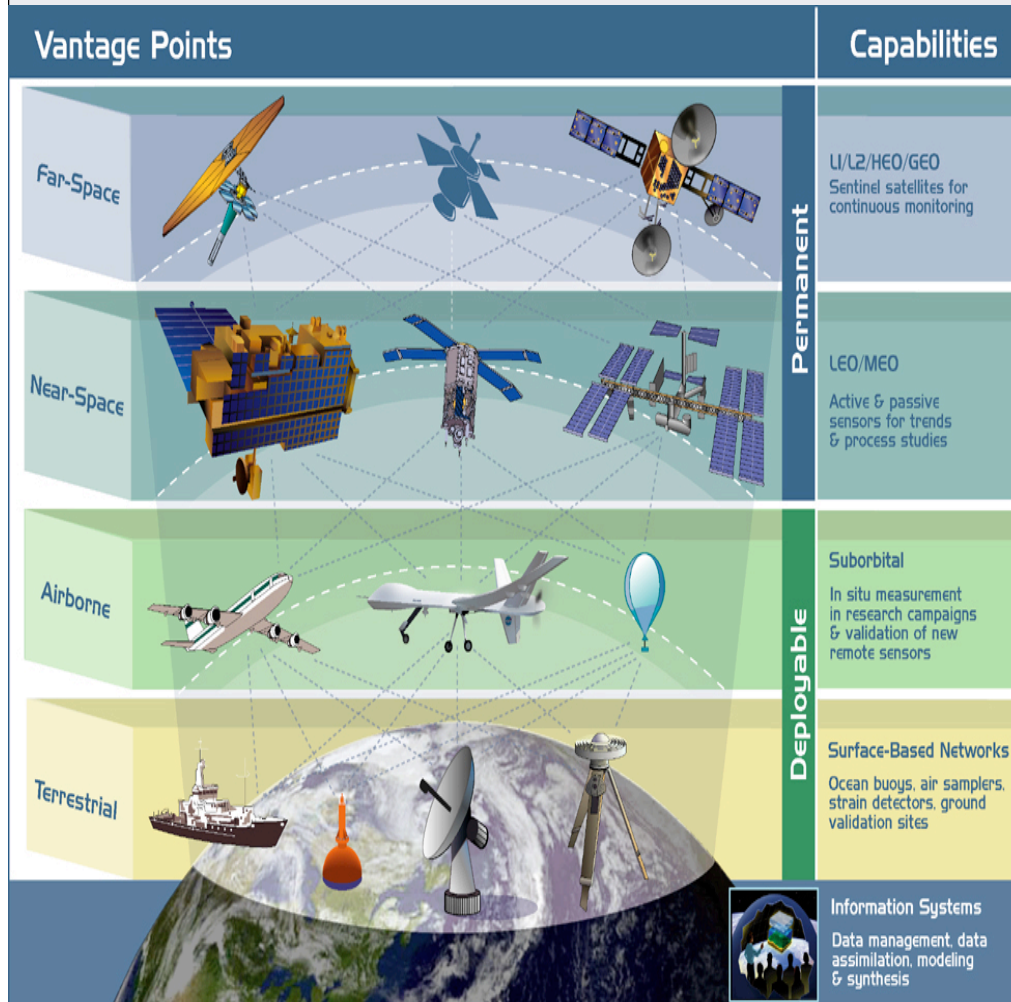


# Next Generation





# Airborne and Ground-Based Measurement Programs



## Satellite Calibration and Validation

Conduct Cal/Val data acquisition for Earth Observing System satellites

## New Sensor and Algorithm Development

Reduce risk for new sensor concepts and algorithm development prior to committing sensors to spacecraft

## Process Studies

Acquire focused measurements with high spatial/temporal resolution, to understand small atmospheric and surface structures and to complement satellite data



# NASA Earth Science Applications



*Discovering and demonstrating  
practical applications of NASA  
Earth science observations and  
research.*

# NASA Earth Science Applications

## Applied Sciences

### Earth Science Results

- Technology
- Observations
- Data and Archives
- Research and Analysis
- Models/ Predictions

### Societal Needs

- Management Decisions
- Policy
- Forecasting
- Response and Recovery
- Resource Planning



# Applied Sciences: Operating Guidelines

***Applied Sciences focuses on those areas where NASA can have greatest impact:***

- ***NASA capability and expertise***
  - ***Demonstrated societal need***
  - ***Receptivity to application—strength of partnerships***
- 
- Select projects through open, competitive solicitations.
  - Define projects and identify needs through partnership with organizations with operational responsibilities.







# Applied Sciences Program

## *Eight Program Elements*



**Agricultural  
Efficiency**



**Air Quality**



**Climate**



**Disaster  
Management**



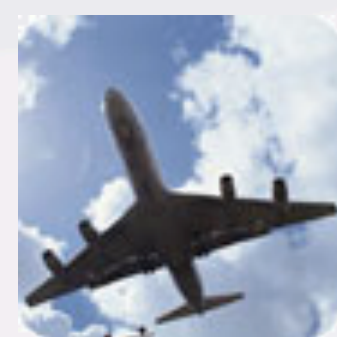
**Ecological  
Forecasting**



**Public Health**



**Water  
Resources**



**Weather**

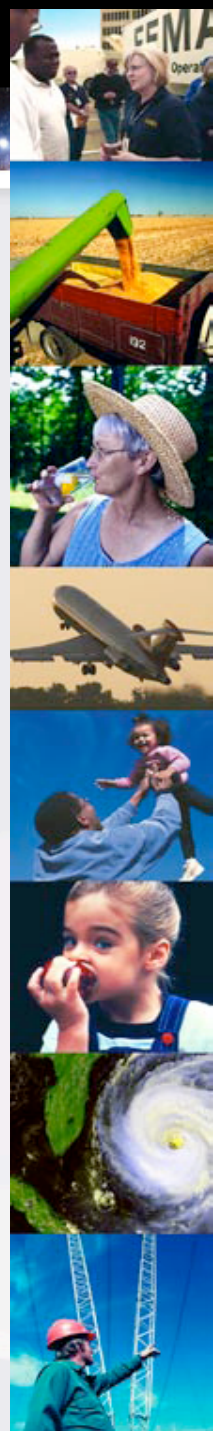


# NASA Earth Science Applications: Current Status

**Applied Sciences: FY 2009 Request:  
\$33.8 M**

**Currently manages 111 competitively  
selected projects :**

- In 31 States
- Federal Partners: 7 USDA agencies, 6 NOAA branches, 4 DOI Agencies, DOE, DOT (FAA), USAID, NRL, DHS, CDC, EPA, Coast Guard
- Regional Partners: e.g. Gulf of Mexico Alliance, Western Governors Association, CATHALAC, ...



DEVELOP fosters human capital development to extend NASA science research to local communities. Students demonstrate to community leaders prototype applications of NASA science measurements and predictions addressing local policy issues. The activities are student led, with advisors and mentors from NASA and other partner organizations.

23 Projects currently

175 Students in FY07 from high school through graduate school from 29 states:

Ames 20

Stennis (includes Southern/LA) 17

Mobile/AL 12

Langley 101

Goddard 13

Savannah/GA 12







# Applied Sciences 2008 Solicitations

**The Applied Sciences Program seeks proposals that develop and demonstrate innovative and practicable applications of NASA Earth science observations and research in eight application areas**

- ***A.18 Decision Support through Earth Science Research Results***
- ***A.19 Feasibility Studies***
- ***A.28 Earth Science for Decision Making: Gulf of Mexico Region***

**(<http://nspires.nasaprs.com/external/>)**



# Limitations of NASA Contributions

- ❑ NASA is a research agency and must transfer results to end user organizations
- ❑ NASA Satellites are research satellites—NASA cannot guarantee continuity of measurements
- ❑ NASA cannot compete with the private sector— e.g. high resolution imaging and mapping
- ❑ The Applied Sciences Program has a wealth of science and measurements to draw from  
... the demand from the end-user community is growing rapidly



# **How can NASA contribute?**

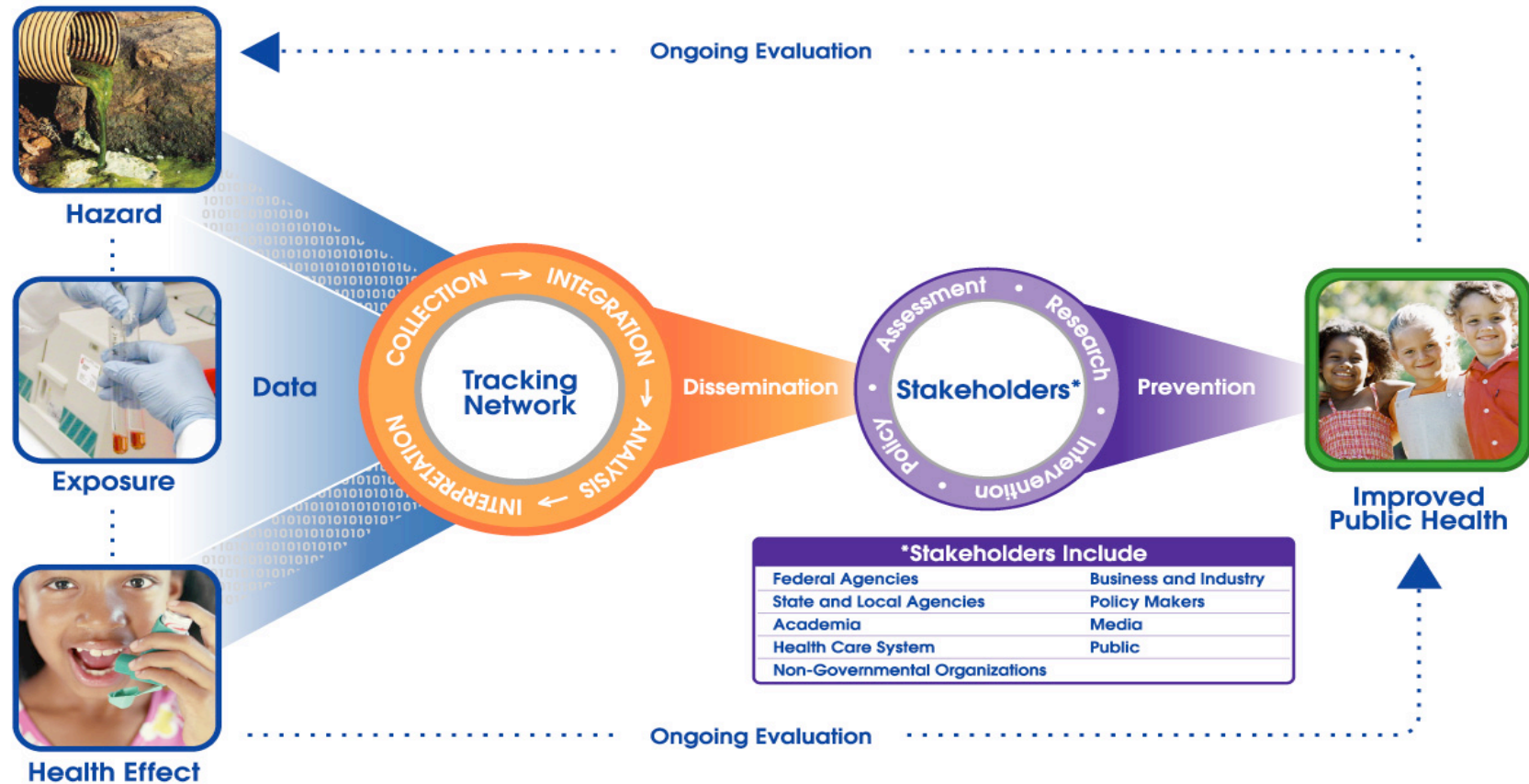
- **Air Quality**
- **Renewable Energy Planning**
- **Planning for and responding to impacts of climate change**
- **Public Health.....**





# Surveillance Project: EPHTN

## ENVIRONMENTAL PUBLIC HEALTH TRACKING



DEPARTMENT OF HEALTH AND HUMAN SERVICES  
CENTERS FOR DISEASE CONTROL AND PREVENTION  
SAFER • HEALTHIER • PEOPLE



# EPHTN/HELIX-Atlanta

Provide information regarding the 5-county Metro-Atlanta Area

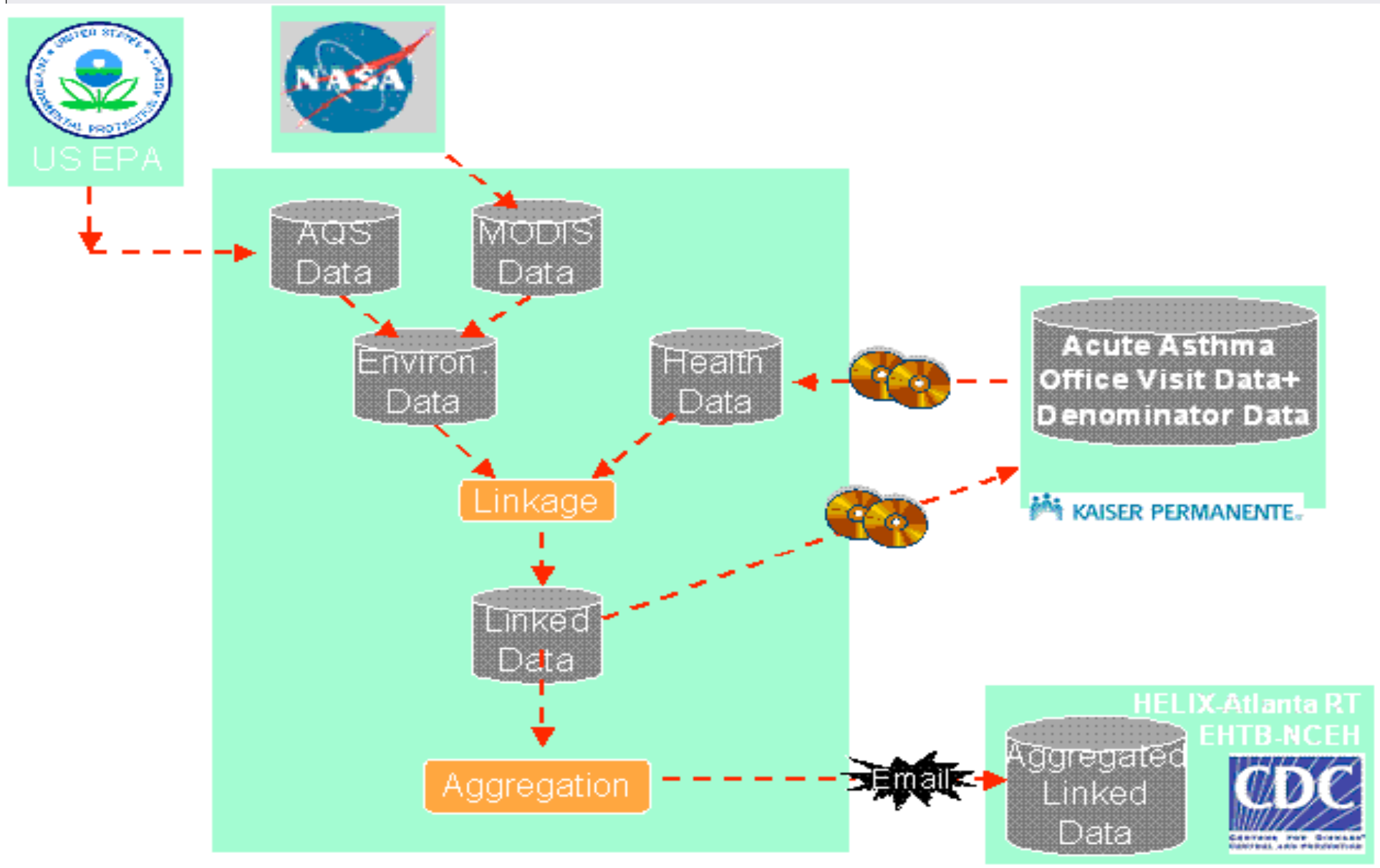
Clayton, Cobb, DeKalb, Fulton, & Gwinnett

Integrate environment & public health data into a local network that is part of a national network

Take action to prevent & control environmentally related health effects



# EPHTN/HELIX System Architecture

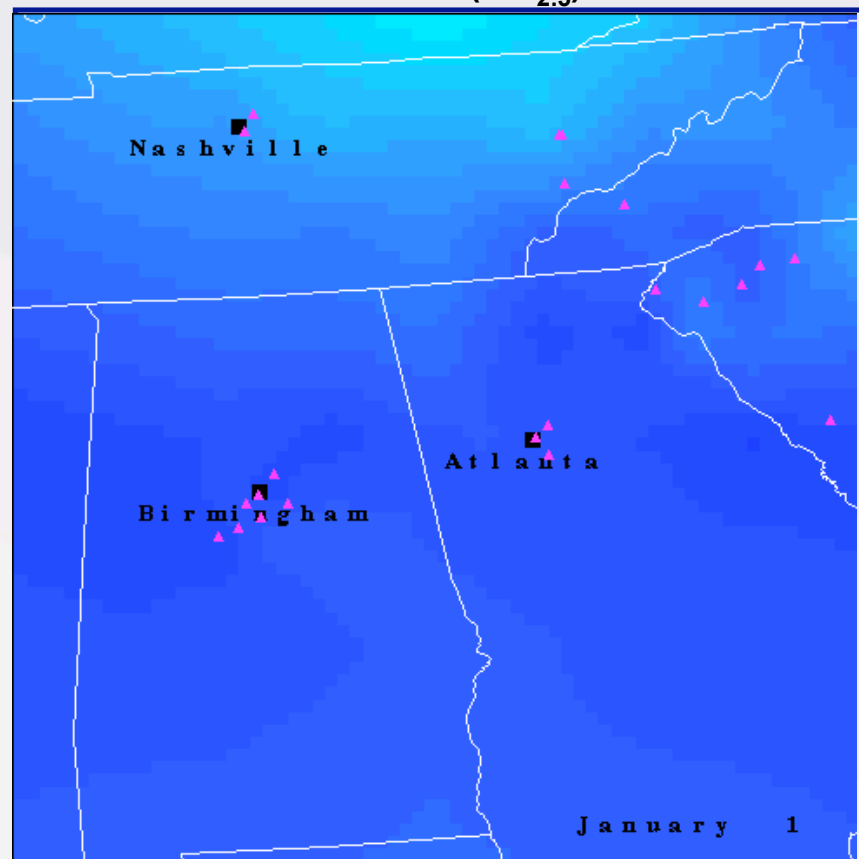




# EPHTN/HELIX Results

v. Dec 2008

## Particulate Matter (PM<sub>2.5</sub>) in 2003



Data from scattered EPA monitoring sites were used to make daily surfaces of particulate matter (PM) concentrations. High concentrations of PM are associated with adverse health reactions, eg. respiratory and cardiovascular problems.

NASA and the CDC are partners in linking environmental and health observations to enhance public health surveillance through the Environmental Public Health Tracking Network (EPHTN)/HELIX-Atlanta project.

The integration of NASA earth science satellite observations, model predictive capabilities, and technology enhances the value of public health decision support.

NASA and CDC verified and validated that augmenting the EPA Air Quality System (AQS) observations with NASA MODIS-derived PM 2.5 observations increases the temporal and spatial resolutions of fine particulate estimates and increases the accuracy in estimating concentrations of PM 2.5.

NASA PIs :

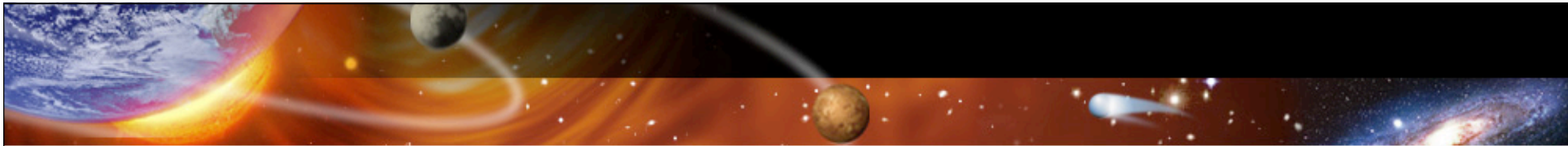
Doug Rickman (MSCF)  
Dale Quattrochi (MSCF)



High : 50  $\mu\text{g}/\text{m}^3$   
Low : 0  $\mu\text{g}/\text{m}^3$

▲ EPA sites





# ***The End***

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